Brain Control Smart Home
Recommendations

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Recommendation

This year’s project started out with ambitious goals and throughout the year the team made lot of progress, but there is still plenty of work to be done before the end goal is met. We recommend the Brain Control Smart Home project be continued. The project itself has a lot of room to grow and potential moving forward. With all of the equipment i.e. the Emotiv and the VR equipment, there are lots of places the project can go as it continues into next year and hopefully further.

Phases

The final report discusses the original timeline and the goals set for the 2015-2016 year. It also gives details on the importance and context of the goals and original phases. This section here presents the next phases of the project, and some advice on how to approach completing the task.

Phase One: Implement EPOC+ Headset input into Android VR

- Android development: The phone will require a connection to a PC that is running the Cognitive Connect program. A client-server approach will be ideal for this. The client side will be the Android phone, and it should continuously listen for messages from the PC. This requires it to run in the background. An Android Service is the best approach, and some code has already been written. The team should add to this code to finish this implementation.

- Cognitive Control: This piece of code will require a little modification to handle server side tasks. It is important to make sure that the server does not introduce any blocking calls. A multi-threaded approach is the best way to guarantee this. The server should run on its own thread. Data will need to be sent from one thread to another, and for this task we recommend using a queue.

With phase one complete the team now has a virtual reality that is easily portable, because they can use the Samsung Gear VR.

Phase Two: Expand on Virtual Reality

- Unity: The main focus of the VR should be the functionality rather than looks. Getting all of the interactions with the headset and other equipment to act as they would in real life is what makes this approach a viable proof of concept.

- VR Features/Interactions: There are some features that are already in the game like turning on lights and opening doors when these are within a certain proximity of the player, but many more can be added. I would suggest features like a fully functioning television, controlling a faucet, control of the refrigerator, etc. Implementing some of these will be fairly similar to what is already in the VR. I also recommend possibly switching the interactions from proximity based to
line of sight i.e. you can use it if you look at it. This will make it so users are less likely to accidentally interact with things that they don’t mean as well as possibly be closer to the real house depending on what direction the real house will be taking.

- Models: The best approach to add more features and models to the VR is to use pre-existing models. The reason is due to the fact that creating professional looking models seen in video games is time consuming. The team should be aware of licensing issues, and verify that the models they use are free source.

Phase two's main purpose is to provide a stable VR environment that is suitable for users outside the team to use and enjoy. The VR is used for testing, and therefore may needed to be altered or expanded upon throughout the project.

Phase Three: Implementing real devices

- Detecting Smart Devices: The team should focus on a method to differentiate one smart device from another. The team will have to factor in several conditions, such as the user's location inside the home, the location of smart devices, and interference from walls or objects.
- Cognitive Connect: The basis for the network has already been designed. However it still requires a method of selecting a device and sending the command.

Phase Four: Testing with Occupational Therapy

- Contact CSU’s Department of Occupational Therapy: This department can help the team get in contact with the targeted demographic.
- Training Users; For the EPOC+ headset to function properly it requires a user to train with it. During the training it is recommend to analyze the EEG data to determine if some thoughts work better than others.
- Test with VR first: The goal here is to verify the headset is configured and works properly. The team can gather feedback from user and implement necessary changes.
- Test Real Devices: This is a major stepping stone for the project and really demonstrates the power and potential. The team should use multiple devices, and verify the network of nodes.

The purpose of phase four is to use the iterative process of engineering to tune the design and verify that this is still a good solution to improve quality of life.

Phase Five: Long term Goals

- Expand on User-Ability: The written code for Cognitive Control is user specific. The goal is to fix this by adding additional parameters during the setup process of training an individual with the headset.
- Simplify Software Implementation: Ideally for this to be a marketable product any software used needs to be packaged up in a single executable. The team should focus on creating a user friendly installer or a easily followable graphical interface to help individuals implement this system in their home.